

Electrostatics and Circuits Review Sheet

AP Physics

1. Electrostatics:

- a. Conservation of charge.
- b. Conductors and insulators.
- c. Ways to charge an object:
 - i. Contact.
 - ii. Induction.
- d. Coulomb's Law:
 - i. Variables (units): Force (N), charge (Coulombs: C), radius (m).
 - ii. Force is a vector.
 - iii. Equation.
- e. Electric field:
 - i. Variables (units): Electric field (N/C), force (N), charge (C).
 - ii. Definition of a test charge.
 - iii. Equation.
 - iv. Electric field is a vector.
 - v. Inside a conductor, E-field equals zero.
- f. Electric field lines:
 - i. They never cross.
 - ii. More lines means more charge.
 - iii. Direction is away from positive and towards negative.
- g. Electric potential energy (analogous to gravitational potential energy).
- h. Electric potential difference:
 - i. Variables (units): Electric potential (Volts: V), electric potential energy (J), charge (C).
 - ii. Electric potential is a scalar.
 - iii. Equation.
 - iv. For a point charge:
 1. Variables (units): Electric potential (V), charge (C), distance (m).
 2. Equation.
- i. Equipotential surfaces and their relation to the electric field.
 - i. Variables (units): Electric field (N/C), electric potential (V), displacement (m).
 - ii. Equation.
- j. Capacitors and dielectrics:
 - i. Variables (units): Capacitance (Farads: F), charge (C), electric potential (V), area (m^2), distance (m).
 - ii. Equations for capacitance.
 - iii. Dielectrics increase the capacitance of a capacitor.
 - iv. Energy stored in a capacitor:
 1. Variables (units): Energy (J), capacitance (F), electric potential (V).
 2. Equations.

2. Circuits:

- a. Electromotive force.
- b. 'True' current versus conventional current.
 - i. Variables (units): Current (Amperes: A), charge (C), time (s).

- ii. Equation.
- c. Ohm's law.
 - i. Variables (units): Electric potential (V), resistance (Ohms: Ω), current (A).
 - ii. Equation.
- d. Resistance and resistivity:
 - i. Variables (units): Resistivity [ρ] ($\Omega \cdot \text{m}$), length (m), area (m^2).
 - ii. Equation.
- e. Electric power:
 - i. Variables (units): Power (W), electric potential (V), current (A), resistance (Ω).
 - ii. Equations.
 - iii. Total or for each individual resistor.
- f. Wiring parts of circuits:
 - i. Series:
 - 1. Equivalent resistance determined by adding resistor values.
 - 2. Equivalent capacitance determined by 'one-over' equation.
 - ii. Parallel:
 - 1. Equivalent resistance determined by 'one-over' equation.
 - 2. Equivalent capacitance determined by adding capacitor values.
 - iii. Equivalence resistance/capacitance:
 - 1. Start from the outside piece and work inwards.
 - 2. Determine how each part is connected.
- g. Internal resistance.
- h. Kirchoff's rules:
 - i. Junction rule.
 - ii. Loop rule.
- i. Measurement of current and voltage.
- j. RC circuits:
 - i. Time constant.
 - ii. Charging equation:
 - 1. Variables (units): Charge (C), time (s), resistance (Ω), capacitance (F).
 - 2. Equation.
 - iii. Discharging equation:
 - 1. Variables (units): Charge (C), time (s), resistance (Ω), capacitance (F).
 - 2. Equation.